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CONTROLLING EFFECT OF *Gliricidiasepium* AND *Lantana camar*a ON *Meloidogyne incognita*INFECTING TWO VARIETIES OF *Citrullus lanatus (*WATERMELON)

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ABSTRACT

Root-knot nematode (Meloidogyneincognita) causes extensive damage to watermelon (Citrulluslanatus). The primary control method for root-knot nematodes in watermelon has been soil fumigation with synthetic chemicals which has adverse effect on human and the environment. Nematicidal activity of indigenous plant has been reported. The field and screen house experiment were therefore carried out to evaluate the nematicidal activity of two botanicals (Gliricidiasepium and Lantanacamara), in controlling root-knot nematode Meloidogyneincognita. This experiment of these infecting two varieties of watermelonwas carried out at the University of Ilorin Teaching and Research farm using randomized complete block design (RCBD) for field, Also, a pot trial experiment was done using a completely randomized block design (CRBD) consisting of ten treatments which includes a control plot with no treatment added. The plots were inoculated withgalled roots to increase the initial nematode population. Phytochemical analysis of the botanicals was carried out to determine the bio active components present.Treatments were applied to all the plots except the control plots.Data were collected on length of vines, number of leaves, initial and final nematode population, and fruit weight at harvest. All statistical analysis were done using Duncan Multiple Range test and Turkey's Honestly Significant Difference test at 5% level of significance. The result of the study shows that both varieties of watermelon were susceptible to M. incognita. The treated plants performed significantly better than the control counterparts with respect to plant height and nematode population. Both botanicals are recommended because they are environmentally friendly.

Key words: *Gliricidiasepium*, *Lantana camar*a, Meloidogyne *incognita*, *Citrullus lanatus*,

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INTRODUCTION

Watermelon (*Citrulluslanatus*) is a fruit crop and a herbaceous creeping plant belonging to the family Cucurbitaceae that includes cantaloupes, cucumbers, pumpkins, squash, zucchini and butternuts. It is indigenous to the dry plains of tropical and subtropical Africa (Zohary, 2012). It is one of the most widely cultivated crops in the world. Its global consumption is greater than any other cucurbit. It accounts for 6.8% of the world area devoted to vegetable production (Guner and Wehner, 2004). The principal watermelon producing countries are China, Turkey, Iran, United States and Egypt (Pastor *et al*., 2009). China produces over 50% of the world supply. China and Turkey have the largest area devoted to watermelon production. Watermelon (*Citrullus lanatus*) is one of the most widely cultivated crops in the world (Huh *et al*., 2008). There are about 1,200 varieties of watermelon in the world and many of them are found in Africa. The largest production of the crop comes from the northern part of Nigeria where suitable agro ecology is found (Adekunle *et al*., 2007). Watermelon is relished by many people across the world as a fresh fruit. This is because watermelon is known to be low in calories but highly nutritious and thirst quenching. As with many other fruits, it is a source of Vitamins A and Vitamin C (Enujeke 2013), which help in boosting the immune system, tissue repair and good vision (Pofu *et al*., 2011). Vitamin C present in watermelon due to its antioxidant activity has shown very important role in human nutrition and preventing various cancers (Tang

et al., 2009). Potassium is also available in it which is believed to help in the control of blood pressure and possibly prevent strokes. (Adekunle *et al*., 2007). Watermelon with red flesh is a significant source of lycopene. Preliminary research indicates the consumption of watermelon may have antihypertensive effects (Figueroa *et al.* 2011). The leaves are reported to be used as green vegetable in some areas while the juice of their roots can be used to stop hemorrhage after abortion (Van Wyk and Gerricke, 2000). They also can be used to make varieties of salads, notably fruit salad. It is also a good source of income to farmers (Shehu *et al*., 2013).

However, one of the major challenges to the production of watermelon is diseases caused by pathogens, which include cucumber mosaic virus, blossom end rot and root-knot nematode, (Mehmet *et al*., 2006). Root-knot nematodes (*Meloidogyneincognita*) are worm like microscopic, multicellular organisms which have a worldwide distribution and wide host range. They attack the roots of the host plant by deforming the normal root cells and establishing a giant cell, forming galls. These galls slow down the transportation of water and nutrient to the plant. Other symptoms may include leaf chlorosis, wilting etc. One of the effective methods of managing root-knot nematode is the use of synthetic chemicals.Successful management of plant parasitic nematodes with synthetic nematicides have been reported by several researchers, but the resultant consequences of their cumulative effect on plants, animals, human and the environment are becoming intolerable. Therefore, the objective of this study was toassess the effectiveness of *Lantana camara* and *Gliricidasepium* on the growth and yield of two watermelon varieties. Hence the search for other acceptable alternative control measures with nematicidal potential becomes essential. Nematicidal activities of some indigenous plants and their products have been reported by the study of Oyedunmade*et al*., (2011); Izuogu*et al*., (2012).

MATERIALS AND METHODS

Description of study location

The field experiment was conducted at University of Ilorin Teaching and Research farm, Ilorin, Kwara State, Nigeria in August, 2018. The farm is approximately 307m above sea level and is located within the Southern Guinea savannah ecological zone (8^0 29'N,4^0 41'E) of Nigeria. The annual rainfall is between 1250-1500 mm with a mean temperature range of between 20^0 and 35^0 C. the soil is a well-drained sandy-loam.

Source of seeds and botanicals:

Two varieties of watermelon, Charleston grey and Kaolack were obtained from Amilengbe in Ilorin, Kwara State. *Gliricidiasepium* leaves was collected at Oke-odo, Tanke Ilorin and *Lantana camara* leaves was collected at Ilesanmi, Tanke, Ilorin Kwara State

Land preparation and Experimental layout (Experiment I)

The field was ploughed, harrowed and ridged. A plot size of 42.5 by 28 meters was mapped out into 3 blocks representing the numbers of replicates. Each block consists of ten plots of treatments. The experimental layout was a 5×2 factorial experiment which was fitted into a Randomized Complete Block Design (RCBD). The five factors/treatments in consideration are aqueous *Lantana camara*, dried *Lantana camara*, aqueous *Gliricidiasepium*, dried *Gliricidiasepium* and control, while the second factors are the two watermelon varieties, kaolack and Charleston gray. The plot was also sprayed with a pre-emergence herbicide (Paraquat) which was carried out using knapsack sprayer.

Nematode extraction

Soil samples were randomly collected at the depth of 0- 30cm on the field with the aid of soil auger. The extraction was conducted using Baermann tray method as described by Whitehead and Hemming (1965). A soft ply tissue was put into the sieve and the sieve was placed on the tray. Two hundred grams (200g) of the soil was poured into the sieve and water was poured into each of the tray for easy migration of nematodes

into water, the extraction was left for 48 hours. The extraction was collected in sampling bottles for nematode population and identification at the laboratory unit of the International Institute of Tropical Agriculture (IITA), Ibadan. This was done to assess the initial population of nematode in the soil before planting.

Inoculation and planting

Meloidogyne incognita infected galled was collected from *Celosia argentea* root, which had been previously identified at International Institute of Tropical Agriculture (IITA), Ibadan. The roots were washed and chopped into smaller pieces before incorporating in to the soil. This was carried out 2 weeks before planting to increase root- knot nematode population in the soil. Three seeds per hole at five (5cm) depth with 1meter spacing which was later thinned to one seedling.

Preparation of plant extract

Lantana camara and *Glricidiasepium* leaves were air dried separately for two weeks after which they were ground. One kilogram of each of the ground treatment was soaked in 4litres of hot water for 24hours. The suspension was sieved and the aqueous extracts were collected in a container, treatments were applied at 100ml per plant. The dried leaves were ground into fine powder and also applied at 100grams to plant stand. Treatment application was done twice; one week after planting and one month after the first application.

Screen house experiment (Experiment II)

The experiment was carried out in the crop protection screen house of the Faculty of Agriculture University of Ilorin.

Experiment layout:

The experiment layout was a 5×2 factorial experiment fitted into a completed randomized block design (CRBD) with first factors representing the treatments used (*Gliricidiasepium* powder, *gliricidiasepium* aqueous, *lantana camara* powder, *lantana camara* aqueous and control) and the second factor representing the two varieties used namely Kaolack and Charleston gray.

Soil sterilization:

Soil sample was collected at a field close to the screen house and was sterilized. Two-hundred-and-fifty-liter drum filled with soil was placed on fire. Water was mixed with the soil to wet before sterilization. The drum was then left for 24 hours to heat well as to destroy existing micro-organisms present while the temperature was being increased at regular interval. Then after, the soil was left to cool till next day.

Preliminary phytochemical screening

Phytochemical screening was carried out at the Department of Chemical Engineering, University of Ilorin, to determine the bioactive composition present in *Lantanacamara* and *Glricidiasepium.*

The GC-MS (gas chromatography-mass spectrophotometer) analysis was carried out so as to get the bioactive compounds and the essential oils present in the leaves. (The GC-MS is an electric automated machine that carries out the all the processes by itself, which include flushing and running the sample). The notable parts of the GC machine include the auto injector syringe and the columns for wash bottles and vials.

Flushing

Flushing of the machine was first done using the solvent that was used for the extraction (methanol), this was done to remove the dirt in the machine and to obtain a uniform result, as using a different solvent would definitely alter the result. Three wash bottles were placed in the GC column, two of them containing the methanol solvent while the other one was left empty. The syringe takes solvent from the first and second wash bottles three times each into the inner part of the GC and the injector, flushes it, and disposes the

whole content in the empty third wash bottle provided. This flushing was done repeatedly for 30 minutes.

Running of the samples

The running of the sample took place after flushing. The rule is to use not more than 1uml of the extract so that the toxicity will not affect the machine's effectiveness. Vial bottles containing the 1uml of the extracts were placed in the GC column. (The GC used could run 15 samples at a time). The auto injector draws the extract up from the vial bottle and injects it into the GC over a set temperature range for the machine (ion source temperature, 250^{o}C, interface temperature, 300^{o}C). Running of the samples takes at least forty-five minutes. Ms Solution software provided by supplier was used to control the system and to acquire the data: Identification of the bioactive compounds and essential oils was carried out by comparing the mass spectra obtained with those of the standard mass spectra obtained from National Institute of Standards and Technology, NIST standard database library software.

Data collection

Data were collected on vine length, number of leaves, fruit weight at harvest, initial and final nematode population. Data collection was on weekly basis.

Data analysis

Data collected were subjected to analysis of variance (ANOVA). And the mean was separated using Duncan Multiple Range test and Turkey's Honestly Significant Difference test at 5% level of significance.

RESULTS

Table 1a shows no significant difference in the number of leaves from week 2 to 10. There was no significant difference between control plots, *Lantana camara* aqueous and dry leaf extracts, *Gliricidiasepium* aqueous and dry extracts with respect to numbers of leaves. The table further shows that there was significant difference between the watermelon varieties in relation to number of leaves as the Charleston gray variety produced more leaves than Kaolack variety.

Table 1a: Main effect of treatments on numbers of leaves on *M. incognita* infested field.

Treatments	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10
G.sepiumAq	4.67	7.33	11	15	18.67	23.17	28.67	32.17	36.17
G.sepium dry	4.83	7.67	11.83	15.83	19.5	23.33	29.17	33.17	37.5
L.camaraAq	4.83	8	12.17	16	19.67	23.83	29.67	33.67	37.83
L.camara dry	4.83	7.83	11.67	15.5	19.33	23.5	29.67	33	36.83
Control	4.67	7.67	11.5	15.5	18.67	23.33	28.83	33.17	37
SEM	0.258	0.333	0.394	0.365	0.387	0.38	0.408	0.568	0.568
	NS	NS	NS	NS	NS	NS	NS	NS	NS
Variety									
Kaolack	4.067	6.4	10.6	14.53	17.8	22.07	27.8	31.47	35.47
Charleston gray	5.53	9	12.67	16.6	20.53	24.8	30.4	34.6	38.667
SEM	0.163	0.211	0.249	0.231	0.245	0.24	0.258	0.359	0.359
	S	S	S	S	S	S	S	S	S

Key – S- Significant, NS- not significant, SEM- Standard error of mean, L.camara- *Lantanacamara*, G.sepium- *Gliricidiasepium*, Aq- Aqueous, WK- Week.

Values in the same column followed by the same letter(s) have no significant difference according to Duncan Multiple Range test for treatments and Tukey's Honestly Significant Difference test for varieties at p=0.05

Table 1b shows the interaction effect of treatments and varieties on numbers of leaves of *Meloidogyne incognita* infested field. The table shows significant difference in the number of leaves produced. Charleston gray treated with all the treatments performed better than Kaolack.

Table 1b: Interaction effect of treatments on numbers of leaves on *M. incognita* infested field

TREATMENTS	VARIETIES	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10
G.sepiumAq	Kaolack	4.33b	6.33c	10.33d	14.33d	17.67d	22c	27d	30.33d	34.33d
	C.gray	5.33a	8.33b	11.67c	15.67c	19.67c	24.33b	30.33b	34b	38b
G.sepium dry	Kaolack	4b	6.33c	10.67d	14.67d	18d	22.33c	28.33c	32c	34.33d
	C.gray	5.67a	9a	13a	14.67d	21b	24.33b	30bc	34.33b	38.67b
L.camaraAq	Kaolack	4b	6.67c	11d	14.67d	17.67d	22c	28c	31.67c	35.33c
	C.gray	5.67a	9.33a	13.33a	17.33a	21.67a	25.67a	31.33a	35.67a	40.33a
L.camara dry	Kaolack	4b	6.33c	10.33d	14.33d	17.67d	21.67cd	27.67c	31.33c	35.33c
	C.gray	5.67a	9.33a	13a	16.67b	21b	25.33a	30.67b	34.67b	38.33b
Control	Kaolack	4b	6.33c	10.67d	14.67d	18d	22.33c	28c	32c	36c
	C.gray	5.33a	9a	12.33b	16.33b	19.33c	24.33b	29.67bc	34.33b	38b
LSD		0.365	0.471	0.558	0.516	0.548	0.537	0.577	0.803	0.803

KEY – S- Significant, NS- not significant L.camara- *Lantana camara*, G.sepium- *Gliricidiasepium*, Aq- Aqueous, WK- Week, C.gray- Charleston gray. LSD- Least Significant Difference.
Values in the same column followed by the same letter(s) have no significant difference according to Fishers LSD test at p=0.05.

Table 2a shows the effect of aqueous and powdered *Gliricidiasepium* and *Lantana camara* on the mean plant height of Kaolack and Charleston gray watermelon varieties in *Meloidogyne incognita* infested field over a period of 10 weeks.
From the table, it was observed that, there was no significant difference from week 2 to week 4 in the mean plant height for all the treatments, however, from week 6 to week 10 the treated plants performed better than the control plants in relations to plant heights. The highest difference was noticed at week 10. The table further showed that from week 2 to week 4, there was no significant difference between the varieties, but from week 5 to week 10 there was significant difference between the varieties with the Kaolack variety performing better in relation to plant height.

Table 2a: Main effect of treatment on plant height on *Meloidigyne incognita* infested field.

Treatments	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10
G.sepiumAq	10.83	25.67	41	54.67[a]	70.5[a]	89.33[a]	110.17[a]	122[a]	134.83[a]
G.sepium dry	11.33	26.17	40.17	53.17[ab]	70.33[a]	88.33[a]	106.83[a]	117.83[a]	130.5[a]
L.camaraAq	11.5	27.17	41.17	53.5[ab]	70.33[a]	89.5[a]	105.83[a]	116.33[a]	130.83[a]
L.camara dry	11.5	29	42	55[a]	73.67[a]	92.17[a]	112.33[a]	122.33[a]	135.83[a]
Control	11	26.67	37	46.83[b]	59.67[b]	75.17[b]	93[b]	108.83[b]	121.83[b]
SEM	0.447	1.123	1.807	2.159	2.805	2.691	2.437	2.74	2.947
	NS	NS	NS						
Variety									
Kaolack	11.2	25.467	39.067	50.6	70.73	89.13	112.2	125.4	136.6
C. gray	11.27	28.4	41.47	54.67	67.07	84.67	99.07	109.53	124.53
SEM	0.283	0.71	1.143	1.37	1.77	1.702	1.541	1.73	1.86
	NS	NS	NS	S	S	S	S	S	S

KEY – S- Significant, NS- not significant, SEM- Standard error of mean, L.camara- *Lantanacamara*, G.sepium- *Gliricidiasepium*, Aq- Aqueous, WK- Week.
Values in the same column followed by the same letter(s) have no significant difference according to Duncan Multiple Range test for treatments and Tukey's Honestly Significant Difference test for varieties at p=0.05

Table 2b shows the Interaction effect of treatments on plant height on *M.incognita* infested field. The table shows significance difference between the varieties. From week 8 to week 10, Kaolack varieties treated with *Gliricidiasepium* Aqueous and dry extracts and *Lantana camara* Aqueous and dry extracts performed better than Charleston gray in Plant height.

Table 2b: Interaction effect of treatments on plant height on *M.incognita* infested field.

TREATMENTS	VVARIETIES	WK2	WK3	WK4	WK5	WK6	WK7	WK8
G.sepiumAq	Kaolack	11ab	24.33bcd	39.67b	551.67ab	73a	90.67b	118b
	C.gray	10.67b	27bcd	42.33a	57.67a	68abc	88b	1102.33d
G.sepium dry	Kaolack	11ab	224.33bc	38b	50.33b	760.67ab	89.33b	112.33c
	C.gray	11.67a	28b	42.33a	56a	70ab	89.33b	101.33d
L.camaraAq	Kaolack	11.33a	26bc	41.67a	54.67a	76.33a	98.33a	117.67b
	C.gray	11.67a	28.33b	40.67ab	52.33ab	76.33a	80.67c	94e

L.camara dry	Kaolack	11.67a	27bc	40.67ab	53.33ab	76a	97.33a	123.67a
	C.gray	11.33a	31a	43.33a	56.67a	71.33ab	87b	101d
Control	Kaolack	11ab	25.67bc	35.33bc	43c	57.67c	70d	89.33f
	C.gray	11ab	27.67b	38.67b	50.67b	61.67b	80.33c	96.67e
LSD		0.632	1.588	2.556	3.053	3.967	3.805	3.446

Key: S- Significant, NS- not significant, L.camara- *Lantanacamara*, G.sepium- *Gliricidiasepium*, Aq- Aqueous, WK- Week. LSD- Least Significant Difference.Values in the same column followed by the same letter(s) have no significant difference according to Duncan Multiple Range test for treatments and Tukey's Honestly Significant Difference test for varieties at p=0.05

Table 3a shows Initial nematode population on natural infested field. The result shows the presence of *S. bradys*, *Helicotylenchus*, *Prateylenchus*, types of nematodes.

Table 3a: Initial nematode population on natural infested field.

Nematode type	Population
Meloidogyne	0c
S. bradys	115bc
helicotylenchus	175b
Prateylenchus	590a

Table 3b shows the effect of the treatments on nematode population after one month of treatment and the final nematode population on Kaolack and Charleston grey varieties of watermelon. The highest nematode population was observed on the untreated plots. The treated plots however show effect of the botanicals used in their treatment. The two treatments were effective and were able to suppress the nematode population.

Table 3b: Main effect of treatments on nematode population on *M. incognita* infested field

TREATMENTS	Nematode population one month after treatment	Final nematode population
L.camaraAq	80.83[a]	26.17[a]
L.camara dry	70.17[a]	21.00[a]
G.sepiumAq	71.50[a]	27.50[a]
G.sepium dry	78.17[a]	33.83[a]
Control	470.17[b]	1032[b]
SEM	11.8	36.49

Key: SEM- Standard error of mean, L.camara- *Lantanacamara*, G.sepium- *Gliricidiasepium*, Aq- Aqueous.

Values in the same column followed by the same letter(s) have no signicant difference according to Duncan Multiple Range test for treatments and Tukey's Honestly Significant Difference test for varieties at p=0.05

Table 4 shows the effect of *Gliricidiasepium, Lantana camara* and control on yield of two varieties of watermelon on *M. incognita* infested field.

Table 4: Effect of treatments on yield of watermelon on *M. incognita* infested field

Treatments	YIELD
Lc Aq	2.9[ab]
Lc dry	2.97[a]
G.S Aq	2.53[ab]
G.Sdry	2.87[ab]
Control	2.07[b]
SEM	0.267
Variety	
1	2.59
2	2.75
SEM	0.17
	NS

Key: SEM- Standard error of mean, L.c- *Lantanacamara*, G.s- *Gliricidiasepium*, Aq- Aqueous.

Values in the same column followed by the same letter(s) have no significant difference according to Duncan Multiple Range test for treatments and Turkey's Honestly Significant Difference test for varieties at p=0.05

Potted experiment (Growth parameters)

Table 5a: shows the result of analysis of main effect of botanicals on numbers of leaves of watermelon. Thetable further shows that there is significant difference at week 2, 7, 9 and 10. Numbers of leaves from plots treated with *Lantanacamara* was not significantly different from the control experiment. There was no significant difference between control plots, *Lantanacamara* aqueous and dry leaf extracts, *Gliricidiasepium* aqueous and dry extracts with respect to numbers of leaves

Table5a: Main effect of treatments on numbers of leaves of watermelon on *M. incognita* infested pot.

Treatments	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10
G.sepiumAq	3.80[b]	6.60	9.90	14.30	18.30	22.10[ab]	24.6	27.00[b]	29.10[b]
G.sepium dry	4.00[ab]	6.70	10.5	13.60	17.60	21.10[ab]	23.90	26.70[b]	29.50[b]
L.camaraAq	4.50[ab]	7.30	10.30	14.20	17.40	20.60[b]	24.30	27.00[b]	29.60[b]
L.camara dry	4.70[a]	6.90	10.8	14.7	18.80	22.20[a]	25.5	29.00[a]	31.60[a]
Control	4.30[ab]	7.10	10.40	14.20	18.30	21.60[ab]	24.40	27.50[ab]	30.20[ab]
SEM	0.235	0.312	0.37	0.405	0.45	0.497	0.35	0.34	0.596

		NS	NS	NS	NS		NS		
Variety									
Kaolack	4.12	6.4	9.88	14.28	18.56	22	25.04	28.28	31
Charleston gray	4.4	7.44	10.88	14.12	17.6	21.04	24.04	26.6	29
SEM	0.332	0.344	0.518	0.573	0.636	0.703	0.789	0.758	0.843
	NS	NS	NS	NS	NS	NS	NS	NS	NS

Key: S- Significant, NS- not significant, SEM- Standard error of mean, L.camara- *Lantanacamara*, G.sepium- *Gliricidiasepium*, Aq- Aqueous, WK- Week.

Values in the same column followed by the same letter(s) have no significant difference according to Duncan Multiple Range test for treatments and Tukey's Honestly Significant Difference test for varieties at p=0.05

Table 5b shows Interaction effect of treatment on numbers of leaves on *M. incognita* infested pot. The table shows significant difference throughout the period of the experiment.

Table 5b: Interaction effect of treatment on numbers of leaveson *M. incognita* infested pot.

TREATMENTS	VARIETIES	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10
G.sepiumAq	Kaolack	3.6c	5.8d	9d	13.8ab	18.2ab	21.8ab	23.6d	25.8c	28.2bcd
	C. gray	4.4b	7.4b	10.8a	14.8a	18.4ab	22.4a	25.6a	28.2b	30bc
G.sepium dry	Kaolack	3.4c	5.8d	10.6a	14.2ab	18.8a	22.2a	25.6a	28.8d	31.8b
	C. gray	4.2b	7.6b	10.4ab	13c	16.4abcd	20b	22.2e	24.6d	27.2d
L.camaraAq	Kaolack	4.4b	6.4c	9d	14ab	17abc	20.4b	24.4c	27.6b	30.4bc
	C. gray	4.6b	8.2a	11a	14.4a	17.8ab	20.8b	24.2c	26.4c	28.8bcd
L.camara dry	Kaolack	5a	7bc	10.6a	14.8a	19.4a	22.8a	26.2a	30.6a	33.6a
	C. gray	4.4b	6.8bc	11a	14.6a	18.2ab	21.6ab	24.8ab	27.4b	29.6bc
Control	Kaolack	4.2b	7bc	10.2ab	14.6a	19.4a	22.8a	25.4ab	28.6b	31b
	C. gray	4.4b	7.2bc	10.6a	13.8ab	17.2abc	20.4b	23.4d	26.4c	29.4bc
LSD		0.332	0.344	0.518	0.573	0.636	0.703	0.789	0.758	0.843

LSD- Least Significant Difference

Values in the same column followed by the same letter(s) have no significant difference according to Fishers LSD test at p=0.05.

Table 6a shows the main effect of treatments on vine length of watermelon on *M. incognita* infested pot. The table shows significant difference from week 3 to week 7 and no significant difference from week 8 to week 10.The table in addition shows significant difference in relation with the two varieties. It shows that Charleston gray performed better than kaolack in relation to plant height.

Table 6a: Main effect of treatments on height of watermelon on *M. incognita* infested pot.

Treatments	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
G.sepiumAq	15.0	26.10^{b}	37.40^{b}	50.30^{b}	61.30b	71.40^{b}	79.90	89.90
G.sepium dry	15.80	25.00^{b}	39.10^{ab}	51.80^{b}	64,30ab	74.00^{ab}	86.00	95.30
L.camaraAq	16.50	24.30^{b}	38.60^{ab}	53.10^{b}	65.00ab	74.40^{ab}	84.30	93.90
L.camara dry	15.90	30.30^{a}	42.40^{a}	58.7^{a}	68.80a	78.50^{ab}	86.00	98.00
Control	16.20	30.80^{a}	42.20^{a}	58.60^{a}	69.50a	79.20^{a}	88.40	97.20
SEM	1.027	1.229	1.259	1.792	1.913	2.327	2.773	3.031

	NS						NS	NS
Variety								
Kaolack	15.6	24.28	36.76	51.6	62.8	72.2	82.12	92.68
C. gray	16.16	30.32	43.12	57.4	68.76	78.8	88.72	97.04
SEM	0.649	0.777	0.796	1.134	1.21	1.472	1.754	1.917
	NS	S	S	S	S	S	S	S

Key: – S- Significant, NS- not significant, SEM- Standard error of mean, L.camara- *Lantanacamara*, G.sepium- *Gliricidiasepium*, Aq- Aqueous, WK- Week.
Values in the same column followed by the same letter(s) have no significant difference according to Duncan Multiple Range test for treatments and Tukey's Honestly Significant Difference test for varieties at p=0.05

Table 6b shows the interaction effect of treatment on plant height on *Meloidogyneincognita* infested pot. The table shows significant difference. The table also shows that *Gliricidiasepium* aqueous extracts performed better with Charleston gray watermelon variety in relation to plant height from week 2 to week 10.

Table 6b: interaction effect of treatments on plant height on *M. incognita* infested pot.

TREATMENTS	VARIETIES	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10
G.sepiumAq	Kaolack	12.8c	22d	32c	46.2c	56.4c	65.2c	72.6b	82.8b	94.8c
	C. gray	17.2a	30.2b	42.8ab	54.4b	66.2b	77.6b	87.2a	97a	106.6a
G.sepium dry	Kaolack	14.8b	22.4d	36.6b	50bcd	63.2bc	72.6bc	84.4ab	94.6a	102.6ab
	C. gray	16.8a	27.6c	41.6ab	53.6b	65.4b	75.4b	87.6a	96a	105a
L.camaraAq	Kaolack	16.4a	22.8d	36b	52bc	62.4bc	71.8bc	81.4abc	91ab	100.6ab
	C. gray	16.6a	25.8cd	41.2ab	54.2b	67.6b	77b	87.2a	96.8a	104.6a
L.camara dry	Kaolack	17.2a	26.8c	39abc	55b	64.6bc	75.2b	86.4ab	98a	107.4a
	C. gray	14.6b	33.8a	45.8a	62.4a	73a	81.8a	90.6a	98a	104.4a
Control	Kaolack	16.8a	27.4c	40.2abc	54.8b	67.4b	76.2b	85.8ab	97a	103.2a
	C. gray	15.6b	34.2a	44.2a	62.4a	71.6a	82.2a	91a	97.4a	103a
LSD		1.452	1.738	1.781	3	2.706	3.291	3.921	4.286	4.71

Key: S- Significant, NS- not significant, L.camara- *Lantanacamara*, G.sepium- *Gliricidiasepium*, Aq- Aqueous, WK- Week. C. gray- Charleston gray, LSD- Least Significant Difference Values in the same column followed by the same letter(s) have no significant difference according to Fishers LSD test at p=0.05

Table 7a shows the effect of the treatments on nematode population after one month of treatment and the final nematode population on Kaolack and Charleston grey varieties of watermelon. The highest nematode population was observed on the untreated varieties. The treated varieties however show effect of the botanicals, *Lantanacamara* and *Gliricidiasepium* as it caused nematode population reduction.

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Table 7: Effect of treatments on nematode population on *M. incognita* infested pot

TREATMENTS	Nematode population one month after treatment	Final nematode population
L.camaraAq	78.40 [a]	29.70 [a]
L.camara dry	78.50 [a]	31.90 [a]
G.sepiumAq	77.30 [a]	39.60 [a]
G.sepium dry	77.30 [a]	40.10 [a]
Control	1664.67[b]	1830[b]
SEM	18.18	21.98

Values in the same column followed by the same letter(s) have no significant difference according to Duncan Multiple Range test for treatments and Tukey's Honestly Significant Difference test for varieties at p=0.05

Tables 8a and 8b shows the various phytochemicals present in the methanolic extracts of *Lantana camara, Gliciridiasepium*. The compounds detected in different species were: *Lantana camara* (14), *Gliciridiasepium*(10).*In L. camara,* n-Hexadecanoic acid (11.80%), Phytol (24.87%), 9, 12, 15-Octadecatrienoic acid, (Z, Z, Z) - (20.04), Ethyl 9, 12, 15-octadecatrienoate (8.59%) and squalene (12.35%) were the major compounds. In *Gliricidiasepium*, 2-Naphthalenol, 5, 6, 7, 8-tetrahydro (8.75%), n-Hexadecanoic acid (5.32%), Hexadecanoic acid, ethyl ester (5.24%) and 9, 12, 15-Octadecatrienoic acid, ethyl ester, (Z, Z, Z) - (21.15%) were the major compounds found. The study reveals the presence of a total of 24 phytochemicals in the methanolic extracts of the leaves of *Lantana camara* and*Gliciridiasepium.* Hexadecanoic acid, ethyl ester, n-Hexadecanoic acid, Hexadecanoic acid, methyl ester, 9,12,15-Octadecatrienoic acid, methyl ester, (Z,Z,Z)-, 9,12,15-Octadecatrienoic acid, (Z,Z,Z)-, 9,12,15-Octadecatrienoic acid, ethyl ester, (Z,Z,Z)-, Octadecanoic acid, Carophyllene, Squalene, Phenol and Phytol were the common compounds detected in the two plant species(*Lantana camara, Gliciridiasepium*.) analyzed which are believed to be responsible fornematicidal effect on nematode population reduction in watermelon.

Table 8a: Proposed Retention Time, Compounds and Peak Area (%) of *Lantana camara* using GC-MS

S.No.	Name of compound	Retention time	Peak area %
1	2(3H)-Naphthalenone, 4,4a,5,6-tetrahydro-7-methyl-	22.789	3.992
2	Carophyllene	24.647	2.229
3	Humulene	25.704	1.602
4	7-Hydroxy-6,9a-dimethyl-3-methylene-decahydro-azuleno[4,5-b]furan-2,9-dione	36.294	0.807
5	Hexadecanoic acid, methyl ester	37.214	2.597

6	n-Hexadecanoic acid	37.646	11.797
7	Hexadecanoic acid, ethyl ester	37.764	4.092
8	9,12,15-Octadecatrienoic acid, 2,3-dihydroxypropyl ester, (Z,Z,Z)-	38.453	3.742
9	Phytol	38.546	24.867
10	9,12,15-Octadecatrienoic acid, (Z,Z,Z)-	38.778	20.041
11	Ethyl 9,12,15-octadecatrienoate	38.840	8.591
12	Dasycarpidan-1-methanol, acetate(ester)	39.347	0.778
13	Hexadecanoic acid, 1-(hydroxymethyl)-1,2-ethanediyl ester	40.729	2.329
14	Squalene	43.632	12.352

Table 8b: Proposed Retention Time, Compounds and Peak Area (%) of *Gliricidiasepium* using GC-MS

S. No.	Name of compound	Retention time	Peak area %
1	Hydrocoumarin	23.865	49.596
2	2-Propenoic acid, 3-(2-hydroxyphenyl)-, (E)-	25.604	1.720
3	1H-2-Benzopyran-1-one, 3,4-dihydro	28.038	3.019
4	2-Naphthalenol, 5,6,7,8-tetrahydro	29.795	8.752
5	n-Hexadecanoic acid	37.708	5.322
6	Hexadecanoic acid, ethyl ester	37.796	1.635
s7	Hexadecanoic acid, ethyl ester	38.584	5.242
8	9,12,15-Octadecatrienoic acid, ethyl ester, (Z,Z,Z)-	38.840	21.147
9	Octadecanoic acid	38.934	2.065
10	Hexadecanoic acid, 1-(hydroxymethyl)-1,2-ethanediyl ester	40.767	1.501

DISCUSSION

Results show that *Gliricidia sepium* and *Lantanacamara* leaf extracts significantly increased the growth of two varieties of watermelon when compared with untreated plants. The performance of the treated plants could be attributed to the effectiveness of the botanicals which have been reported by researchers to possess nematicidal effect (Coimbra et al., 2006). This agrees with the research of Adekunle and Akinlua, (2007) who reported nematicidal activity of G. sepium and L. leucocephala on nematode infecting okra. The positive significance observed implies that the treatments might have acted as organic fertilizers as against the control plots.

The untreated control plants recorded significantly higher soil nematode population; high nematode population has an adverse effect on plant growth (Izuogu et al., 2010). The higher nematode population may be attributed to the absence of *Lantanacamara* and *Gliricidiasepium* leaf extracts which was buttressed by the research of (Feyisa *et al*.,2014) . *Lantana camara, Gliciridia sepium* are rich sources of polyphenols and amino acids, (Kumar et al., 2015). Palmitic acid (n-Hexadecanoic acid) carries nematicidal and pesticidal activities (Cho et al., 2010). Phenol, flavonoids and phytols have high rate of nematicidal activity, antifungal, antioxidant activities etc. (Bashir et al., 2012). Stearic acid (Hexadecanoic acid, ethyl ester and Hexadecanoic acid, methyl ester). The various organic compounds found in a single plant tissue can confer synergistic nematicidal properties, leading to high nematode mortality (Chitwood, D.J., 2002). Several studies reported the nematicidal, fungicidal, insecticidal and anti-microbial activities of phenols and phytols (Ahmad et al., 2011; Dambolena et al., 2011; Nostro & Papalia, 2012). Triterpenoids e.gsqualenes and terpenes e.gcarophyllene has been reported to show pesticidal activities (Duke, 1991)

CONCLUSION

Gliricidiasepium and *Lantanacamara* were effective in control of *Meloidogyneincognita* as evidenced from nematode population reduction. The use of botanicals should be given high priority because they are more environmental friendly. The results of this experiment showed that there is need for further research on the use of organic plant materials in suppressing nematodes population in the soil. This is more so, because of the adverse effect and the threat synthetic nematicides poses to our environment. *Gliricidiasepium* and *Lantanacamara* are environmentally friendly and also serve to amend the soil. The study therefore recommends*Gliricidiasepium* and *Lantanacamara*extracts for the control of root knot infected crops in nematodes endemic soils. This technology is hereby recommended to farmers growing nematode susceptible crops including*Citrullus lanatus (*watermelon) in all nematode endemic soil.

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